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MACROECONOMIC SHOCKS ACROSS CENTRAL EUROPEAN COUNTRIES

Abstract

The purpose of the research was to investigate the transmission mechanism of macroeconomic shocks across EU countries and Central European Countries (CECs). It was expected that the findings would enable to verify the following hypotheses: If it turns out that macroeconomic shocks can be transmitted from the EU to Central European countries (CECs) rather than in opposite way, one should not be afraid that asymmetric shocks across CECs will destabilise the European integration. Moreover, if the size of shocks to EU countries is much smaller than to CECs, this would suggest that the integration process creates mechanisms which limit the extent of the disturbances in output. Therefore, the access of CECs to EU is likely to accelerate reducing the size of shocks. The research was based on four VAR models to which Granger non-causality tests, deletion tests, variance decompositions were applied.

Introduction

The process of European monetary unification has resulted in the increasing interest of macroeconomic shocks[i]. The sacrifice of monetary policy has raised misgivings that the specific-country shocks could threaten the stabilisation of EMU countries. If disturbances are distributed asymmetrically

across countries, an asymmetric policy response will be required what may not be consistent with the constraints of monetary union. Symmetrical policy responses will be efficient only if shocks are distributed symmetrically across countries.

A threat of the negative results of asymmetric shocks is one of arguments against the enlargement of EU. The globalisation process should result in the symmetrical distribution of macroeconomic disturbances across countries. Maybe, it is too early to expect only symmetrical shocks across whole Europe but it is worth to know to what extent shocks transmitted from Central European Countries (CECs) really threaten the European integration[ii]. If it turns out that

- macroeconomic shocks can be transmitted from the EU to Central European countries (CECs) rather than in opposite way,

one should not be afraid that asymmetric shocks across CECs will destabilise the European integration.

Moreover,

- if the size of shocks to EU countries is much smaller than to CECs, this would suggest that the integration process creates mechanisms which limit the extent of the disturbances in output.

Therefore, the access of CECs to EU is likely to accelerate reducing the size of shocks.

The purpose of the research was to investigate the transmission mechanism of output shocks across EU countries and CECs. On the one hand the output growth of EU, as the whole, as well as the output growths of Germany and Austria were considered and on the other hand the output growths of the Czech Republic, Hungary, Poland and Slovenia were included. It was expected that the findings would allow to verify two above hypotheses.

Methodology

Methods

The research was based on four VAR models. The first model included the change in output of EU and changes in outputs of four considered CECs (i.e. the Czech Republic, Hungary, Poland and Slovenia). The change in output of EU was replaced by the change in output of Germany in the second model and by the change in output of Austria in the third one. The fourth model covered only changes in outputs of CECs.

Each model included constant, trend and centred seasonal dummies. A uniform lag of four was chosen in order to preserve the symmetry of the specification across countries. Granger non-causality tests, deletion tests, variance decompositions were applied to above VAR models.

Output shocks were represented by innovations included in residuals from equations in VAR models. In the paper two kinds of shocks were considered. An asymmetric shock or a country-specific shock, when disturbances in output are specific in one country and a symmetric shock, when disturbances in output are distributed symmetrically across countries.

Data

For each country the output growth was calculated as the first difference of the logarithm of an index of industry production[iii] Monthly data on the index of industry production in EU, Germany and Austria were obtained from the Eurostat publications. For the Czech Republic, Hungary, Poland and Slovenia time series of the industry index were coming from national Central Statistical Offices. For each country, except Austria, monthly data were collected for January 1993 to December 1999, for Austria from December 1994 to January 1999 (the data for Austria have been published by the Eurostat since December 1994).

Estimations

At the beginning the ADF test was applied to check whether the variables (in first differences) were stationary. The null hypothesis that the variable is I(0) could not be rejected in respect to each variable.

The results of diagnostic tests for particular equations in each VAR model are presented in Tables 1-4.

Table 1. Diagnostic tests for the first VAR model

	Output growth of				
Diagnostic statistics	EU	Poland	Slovenia	Czech Re.	Hungary
Residual serial correlation LM(1) $\chi^2(1)$	3.97 > *3.84*	0.098	1.92	0.58	0.015

Functional form misspecification Ramsey's Reset test $\chi^2(1)$	0.94	0.096	3.19	0.33	0.07
Normality of residuals Bera-Jarque test $\chi^2(2)$	0.68	0.58	0.25	8.14 > *5.99*	1.35
Heterosceda sticity LM(1) $\chi^2(1)$	0.24	1.49	0.92	0.42	7.9 > *3.84*

Table 2. Diagnostic tests for the second VAR model

	Output growth of				
Diagnostic statistics	Germany	Poland	Slovenia	Czech Re.	Hungary
Residual serial correlation LM(1) $\chi^2(1)$	3.54	0.51	1.9	1.37	0.00004
Functional form misspecification Ramsey's Reset test $\chi^2(1)$	0.11	0.08	0.8	0.007	0.065
Normality of residuals Bera-Jarque test $\chi^2(2)$	1.02	0.33	1.2	2.89	0.20
Heteroscedasti city LM(1) $\chi^2(1)$	0.46	3.4	3.3	0.78	11.61 *> 3.84*

Table 3. Diagnostic tests for the third VAR model

	Output growth of				
Diagnostic statistics	Austria	Poland	Slovenia	Czech Re.	Hungary
Residual serial correlation LM(1) $\chi^2(1)$	0.99	0.34	0.59	1.43	1.92
Functional form					

misspecification Ramsey's Reset test $\chi^2(1)$	4.69 > *3.84*	0.32	2.11	0.09	1.24
Normality of residuals Bera-Jarque test $\chi^2(2)$	3.48	2.04	0.22	3.43	1.18
Heteroscedasticity LM(1) $\chi^2(1)$	0.08	1.69	0.02	0.05	0.99

Table 4. Diagnostic tests for the fourth VAR model

	Output growth of			
Diagnostic statistics	Poland	Slovenia	Czech Re.	Hungary
Residual serial correlation LM(1) $\chi^2(1)$	0.005	3.22	0.068	0.015
Functional form misspecification Ramsey's Reset test $\chi^2(1)$	0.003	1.36	0.046	0.22
Normality of residuals Bera-Jarque test $\chi^2(2)$	0.61	0.54	9.66 > *5.99*	1.24
Heteroscedasticity LM(1) $\chi^2(1)$	0.47	2.65	0.77	10.8 > *3.84*

The biggest problem was with the equation of the Hungarian output. In three VAR models the null hypothesis of no ARCH was rejected for this equation. However, other diagnostic tests did not signal any problems. The similar situation was with the equation for the Czech Republic's output. In two VAR model residuals from this equation were not normal distributed. In spite of these problems it seems that quality of estimations can be acceptable.

Findings

The important aspect of the international transmission of output shocks between countries is its direction. At the beginning two questions were considered.

1. Have the output growth of the EU countries affected the changes in outputs of CECs?
2. Could output shocks of CECs have the significant impact on the output of EU countries?

These issues were examined by Granger non-causality tests. The results are presented in Table 5.

Table 5. Granger non-causality test

I. Have the changes in outputs of CECs (the Czech Republic, Hungary, Poland and Slovenia as a group) been affected by the output growth of:

	EU		Germany		**Austria**	
LR test $\chi^2(16)$	25.02	No	22.51	No	**37.08**	**Yes**

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of output growth of EU, Germany and Austria (respectively in the first, second and third VAR model) in the block of equations explaining the variables of output growth of the Czech Republic, Hungary, Poland and Slovenia are zero Critical value 26.3 (95%)

II. Have the changes in outputs of CECs (the Czech Republic, Hungary, Poland and Slovenia as a group) influenced the output growth of:

	EU		Germany		Austria	
LR test $\chi^2(16)$	21.12	No	18.18	No	15.35	No

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of variables: the changes in outputs of the Czech Republic, Hungary, Poland and Slovenia in the equation explaining the variable of output growth of EU, Germany and Austria (respectively in the first, second and third VAR model) are zero Critical value 26.3 (95%)

The results pointed out that disturbances in both the output growth of EU and the output growth of Germany have not effected the changes in outputs of the group of CECs included in the research. Only the impact of disturbances in the output growth of Austria could be significant.

On the other hand the findings clearly suggested that disturbances in outputs of the whole group of considered CECs have not affected of output of EU, Germany and Austria, respectively.

The obtained results induced to investigate closely relationships between outputs of EU, Germany, Austria and output of particular CECs. Even if the changes in EU output growth and Germany's output growth have not influenced significantly the whole group of considered CECs, it does not mean that they have not affected output of each of CECs. This question was examined by deletion tests.

Table 6. Testing for the significance of the impact of the **EU output growth** on the changes in output of particular CECs

	Czech Rep.	Hungary	**Poland**	**Slovenia**
Deletion test	1.26	1.76	**11.19**	**11.33**
LR $\chi^2(4)$	NO	NO	**YES**	**YES**

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of the EU output growth are zero in the output growth equation for the Czech Republic, Hungary, Poland and Slovenia, respectively. Critical value 9.49 (95%)

Table 7. Testing for the significance of the impact of **Germany's output growth** on the changes in output of particular CECs

	Czech Rep.	Hungary	**Poland**	Slovenia
Deletion test	6.07	2.47	**11.84**	5.84
LR $\chi^2(4)$	NO	NO	**YES**	NO

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of Germany's output growth are zero in the output growth equation for the Czech Republic, Hungary, Poland and Slovenia, respectively. Critical value 9.49 (95%)

Table 8. Testing for the significance of the impact of **Austria's output growth** on the changes in output of particular CECs

	Czech Rep.	Hungary	**Poland**	Slovenia
Deletion test	**10.76**	0.74	**16.03**	3.79
LR $\chi^2(4)$	**YES**	NO	**YES**	NO

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of Austria's output growth are zero in the output growth equation for the Czech Republic, Hungary, Poland and Slovenia, respectively. Critical value 9.49 (95%)

The findings revealed that only Poland's output growth has been affected by the changes in outputs of both EU, Germany and Austria. With respect to other CECs, the EU output growth had the significant impact on the changes in Slovenia's output while Austria's output growth has influenced the changes in the Czech output. The impact of outputs of EU countries occurred not to be statistically significant only with respect to Hungary's output growth.

Therefore, the results suggested that any transmission of output shocks could go from EU countries mainly to Poland and to the limited extend to Slovenia and the Czech Republic.

The exercise was repeated in the opposite direction to reveal the potential impact of the output growth of the particular CECs on EU countries. The results of deletion tests are presented in Tables 9-12.

Table 9. Testing for the significance of the impact of **Poland's output growth** on the changes in output of particular EU countries

	EU	Germany	Austria
Deletion test LR $\chi^2(4)$	**11.52 YES**	4.17 NO	6.77 NO

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of Poland's output growth are zero in the output growth equation for the EU, as a whole, Germany and Austria, respectively. Critical value 9.49 (95%)

Table 10. Testing for the significance of the impact of **Slovenia's output growth** on the changes in output of particular EU countries

	EU	Germany	Austria
Deletion test LR $\chi^2(4)$	6.26 NO	8.76 NO	1.71 NO

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of Slovenia's output growth are zero in the output growth equation for the EU, as a whole, Germany and Austria, respectively. Critical value 9.49 (95%)

Table 11. Testing for the significance of the impact of **the Czech output growth** on the changes in output of particular EU countries

	EU	Germany	Austria
Deletion test LR $\chi^2(4)$	6.56 NO	0.68 NO	8.75 NO

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of the Czech output growth are zero in the output growth equation for the EU, as a whole, Germany and Austria , respectively. Critical value 9.49 (95%)

Table 12. Testing for the significance of the impact of **Hungary's output growth** on the changes in output of particular EU countries

	EU	Germany	Austria
Deletion test LR $\chi^2(4)$	3.11 NO	3.18 NO	1.62 NO

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of Hungary's output growth are zero in the output growth equation for the EU, as a whole, Germany and Austria, respectively. Critical value 9.49 (95%)

The findings suggest that within CECs only Poland's output growth had the statistically significant impact only on the changes in EU production. Movements in Poland's output were not significant in explaining the changes in both Germany's and Austria's productions or Poland's nearest neighbours.

The obtained results pointed out the existence of the one–way relationships rather than the feedbacks between the output growths of EU countries and CECs. In the light of such evidence it is interesting to ask about the direction of relations between the changes in production within CECs considered in the research. The same tests were applied to the VAR model including only the output growths of CECs.

Table 13. Testing for the significance of the impact of the output growths of three countries (as a group) of CECs on the changes in output of the fourth country of CECs.

LR test of block Granger non-causality in the VAR

Independent variables = lagged output growth of:	Dependent variable = output growth of:	LR statistic $\chi^2(12)$	
Slovenia, Czech Republic, Hungary	⇒ **Poland**	**23.81**	**YES**
Poland, Czech Republic, Hungary	⇒ Slovenia	17.67	NO
Poland, Slovenia, Hungary	⇒ **Czech Republic**	**28.24**	**YES**
Poland, Slovenia, Czech Republic	⇒ **Hungary**	**26.72**	**YES**

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of output growths of three countries of CECs (respectively in the fourth VAR model) in the block of the equations explaining the variable of output growth of the fourth country of CECs are zero
Critical value 21 (95%)

Only Slovenia's output growth was not influenced by changes in production of other CECs (considered as a group) included in the research. Examining more detail the relationships between output growths within CECs pointed out the results presented in Table 14.

Table 14. Testing for the significance of the impact of the output growths of particular three countries of CECs on the changes in output of the fourth country of CECs.

Deletion test LR statistic $\chi^2(4)$

Dependent variable in the equation of the VAR model = output growth of:

Independent variable = output growth of:	Poland	Slovenia	Czech Rep.	Hungary
Poland	xxx	3.08	5.33	8.18
Slovenia	6.83	xxx	**10.69**	0.46
Czech Rep.	7. 29	6.73	xxx	**15.73**

Hungary	**11. 37**	2.04	**10.88**	Xxx

The above statistic is for testing the null hypothesis that the coefficients of the lagged values of independent variable are zero in the equation of the dependent variable. Critical value 9.49 (95%)

Only one feedback was found between changes in productions of the Czech Republic and Hungary. Only the Czech output growth was influenced by the changes in productions of more than one country, i.e. Slovenia's and Hungary's output growths. The results of the deletion test confirmed the previous findings that Slovenia's production was influenced by the output growth of none of other CECs. It is interesting that Poland's production growth had the statistically significant impact on explaining the changes in output of no other CECs included in the research. It could result from differences in a size of market and a volume of industry production between Poland and the others. Moreover, Poland's output growth was influenced only by Hungary's production. The comparison of this result with evidence that the output growths of both EU and Germany and Austria affected Poland's production, suggested the importance of the output shock transmission to Poland rather from EU countries than from other CECs. The similar conclusion refers to Slovenia.

Finally, basing on the deletion test results (Tables 6-12 and 14) it was possible to determine the potential directions of the output shock transmission, see Table 15.

Table 15. The potential directions of the output shock transmission.
(Summary of the deletion test results).

From country \ To country	EU	Germany	Austria	Poland	Slovenia	Czech Republ	Hungary
EU	xxx	xxx	xxx	**YES**	**YES**	NO	NO
Germany	xxx	xxx	xxx	**YES**	NO	NO	NO
Austria	xxx	xxx	xxx	**YES**	**YES**	**YES**	NO
Poland	**YES**	NO	NO	xxx	NO	NO	NO
Slovenia	NO	NO	NO	NO	xxx	**YES**	NO
Czech Rep.	NO	NO	NO	NO	NO	xxx	**YES**
Hungary	NO	NO	NO	**YES**	NO	**YES**	xxx

Source: Tables 6-12 and 14

Can output shocks, transmitted in the directions showed above, destabilise the European integration process? If production in countries involved in the transmission of shocks undergoes the similar disturbances, it can signal that asymmetric shocks will not threaten the success of the EU enlargement. Examining this idea, at first, it was tested to what extent shocks in different output equations in the VAR models[iv] are correlated. Secondly, the variance decomposition was applied.

Correlation coefficients between output shocks in different production equations are presented in Table 16.

Table 16. Correlation coefficients between output shocks in different production equations for EU countries and CECs.

	EU first VAR	Germany second VAR	Austria third VAR	Poland fourth VAR	Slovenia fourth VAR	Czech Rep. fourth VAR	Hungary fourth VAR
EU	1						
Germany	xxx	1					
Austria	xxx	xxx	1				
Poland	0.26	0.31	0.12	1			
Slovenia	0.08	0.35	-0.05	0.35	1		
Czech Rep.	0.34	0.16	0.24	0.42	0.18	1	
Hungary	0.03	0.04	-0.03	0.37	0.08	0.05	1

Correlation coefficient are calculated between residuals from the particular production equations and refer to the entire data period, excluded coefficient between output shocks in the third VAR model (which included Austria's, Poland's, Slovenia's, the Czech Republic's and Hungary's production equations for the shorter period).

Beginning from bad news, in general, the values of correlation coefficients between output shocks are low. It can be specially alarming with regard to Slovenia and the Czech Republic. Slovenia's output growth was influenced by changes in EU production and Austria's production (see Table 15). It means that output shocks can be transmitted from EU, as a whole, and Austria to Slovenia. However, disturbances in Slovenia's production are completely not correlated with disturbances in EU production and Austria's production (the correlation coefficients are equal to 0.08 and – 0.05, respectively). Therefore, shocks transmitted from EU and Austria would be asymmetric regarding Slovenia's output. As a consequence, macroeconomic policy in Slovenia would have to respond to these shocks in different way than EU and Austria. Output shocks transmitted from Austria could be also asymmetric with reference to Poland's production (the correlation coefficient 0.12) and even the Czech output (the correlation coefficient only 0.24).

It is surprise that within CECs, except Poland, output shocks are not correlated. It means that disturbances in production could be distributed asymmetrically across the Czech Republic, Hungary and Slovenia. Taking into account the potential directions of the output shock transmission, the Czech Republic could be suffered from asymmetric shocks transmitted from Slovenia and Hungary, remembering that output shocks from Austria would be also asymmetric, it seems that the Czech Republic would be in trouble to conduct any common policy response.

In the light of the findings Hungary looks a little bit like an outsider. The disturbances in Hungary's production were correlated with the disturbances neither in the EU output growth and Germany's production, nor even in Austria's output shocks , what it seems to be strange taking into account historical connection between these two countries. Moreover, Hungary's output growth was

influenced only by the changes in productions of two CECs, Poland and the Czech Republic. The disturbances in the Czech output growth were not similar to the disturbances in Hungary's production. As a consequence, output shocks transmitted from the Czech Republic to Hungary would be asymmetric.

More optimistic suggestions from the findings. In general, the values of correlation coefficients between disturbances in output growths of the following pairs of countries: Germany-Poland and Germany-Slovenia as well as EU-the Czech Republic can be interpreted as a signal that these three CECs are on the proper path of the European integration (the coefficients are higher than 30%). There is also a certain suggestion that any common policy response to output shocks could be carried out within CECs. The disturbances in Poland's output growth were correlated with disturbances in productions of all other CECs. The coefficients were not high enough to suggest clearly that symmetrical policy responses to output shocks in Poland and each of other CECs would suffice, however, the policy responses could be similar, at least, in some aspects.

Returning to bad news, the findings require the further studies. Correlation is too simple method to give the robust evidence of the extent to what asymmetric output shocks suggested by the findings could threaten the process of the EU enlargement. It is important to know what is the contribution of output disturbances transmitted from particular countries to a given country to movements in output of this country at short and medium-term horizons. This issue can be examined by the variance decomposition. The results are presented in a form of graphs 1-17. Each graph has the following interpretation. The *k* month-ahead forecast error in output of a given country is defined as the difference between the actual value of output and its forecast as of *k* months earlier. This forecast error is due to disturbances in output growths of a given country as well as other countries in the last *k* months. The point of the graph for output of a given country at horizon *k*, $k = 1,..,24$ gives the percentage of variance of the k-month ahead forecast error due to disturbances in output growths of other countries included in the research.

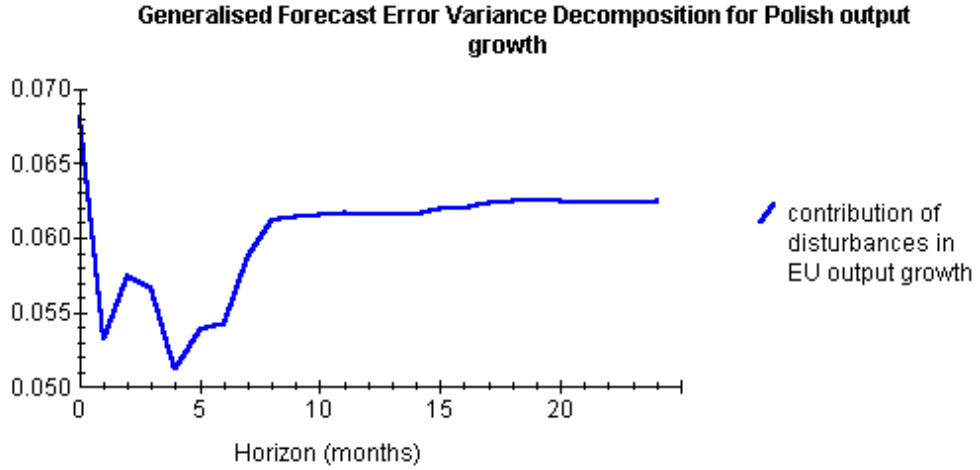

Fig.1 Contribution of disturbances in EU output growth to movements in Poland's output

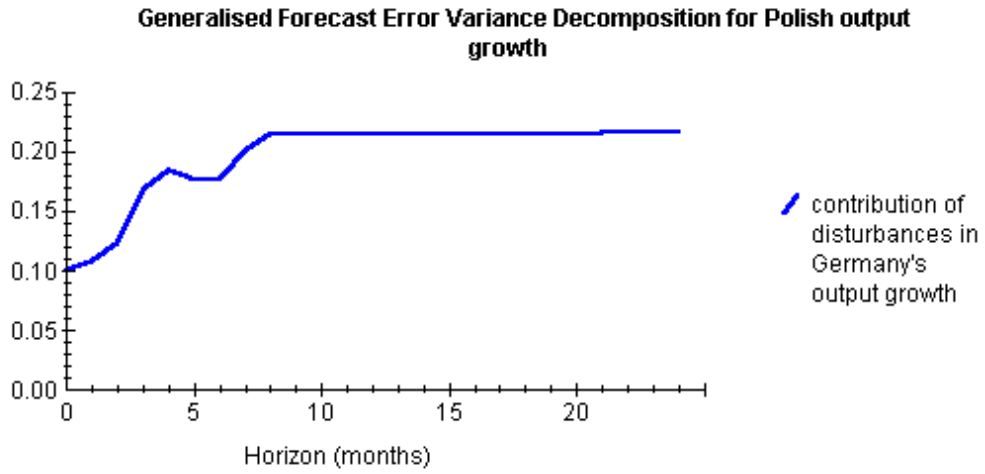

Fig.2. Contribution of disturbances in Germany's output growth to movements in Poland's output

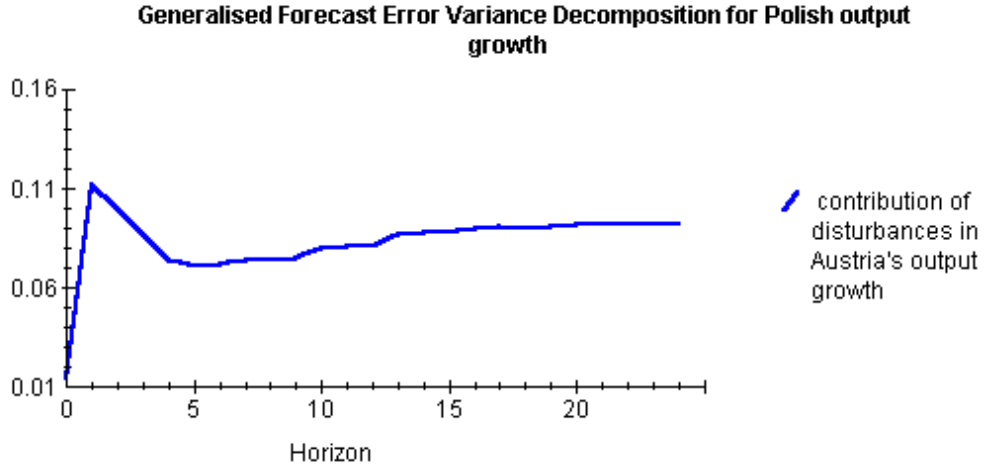

Fig.3. Contribution of disturbances in Austria's output growth to movements in Poland's output

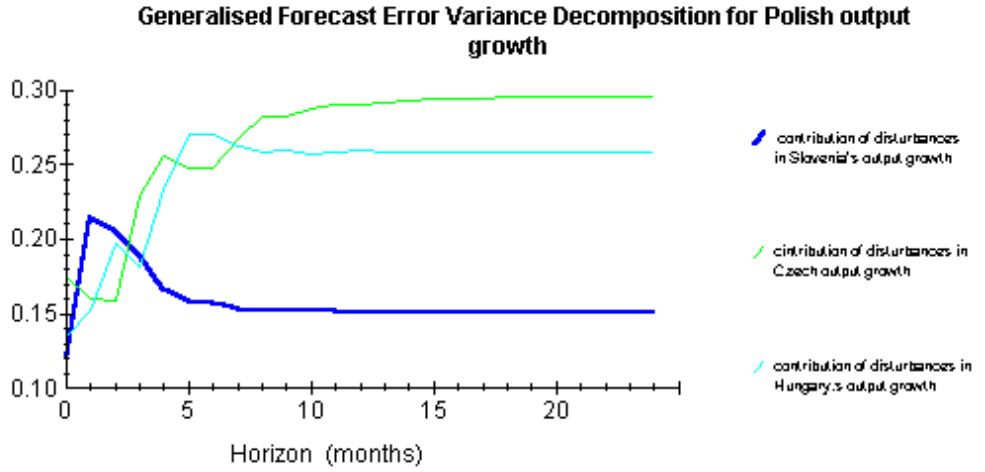

Fig.4. Contribution of disturbances in output growths of Slovenia, the Czech Rep. and Hungary to movements in Poland's output

The results from the previous tests suggested that output shocks could be transmitted to Poland from EU, Germany and Austria. The variance decomposition for Poland's output growth revealed that the contributions of disturbances in EU production and Austria's production to movements in Polish output would be very small, less 10%. Therefore, even if these shocks were asymmetric, their impact on the changes in Poland's production would not be significant. Regarding output shock from Germany, its contribution to movements in Poland's output is rising from 10% to 20% over first six months after shock and stabilising on the level of 21%. Therefore, Germany's output shock could be an important factor influencing Poland's output growth. Remembering that the correlation coefficient of output disturbances between Germany and Poland was equal to 31%, it seems it is possible to suppose that this shock would be distributed symmetrically across Germany and Poland, at least to some degree. The same conclusion should held in regard to output shock transmitted from Hungary to Poland (the correlation coefficient = 37%).

The findings suggest that output shocks, which have the important impact on the changes in Polish production, would be rather symmetric as a consequence the common policy response could be conducted.

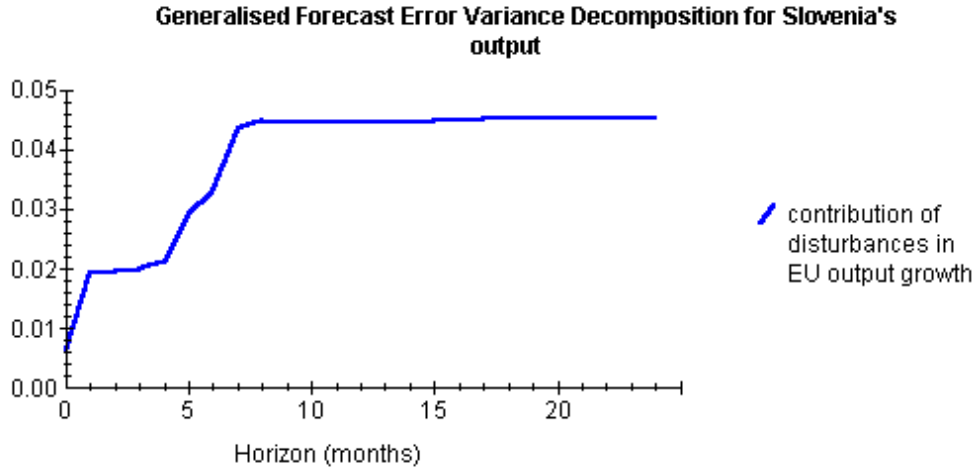

Fig.5. Contribution of disturbances in EU output growth to movements in Slovenia's output

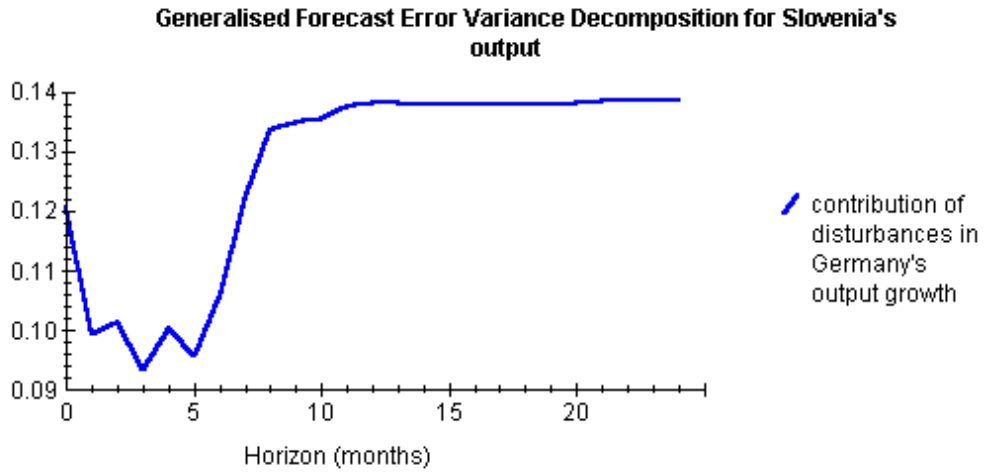

Fig.6. Contribution of disturbances in Germany's output growth to movements in Slovenia's output

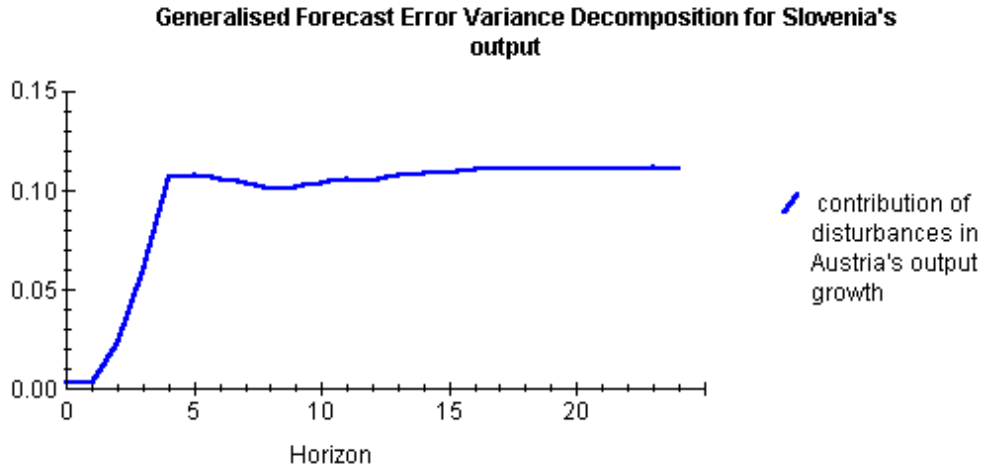

Fig.7. Contribution of disturbances in Austria's output growth to movements in Slovenia's output

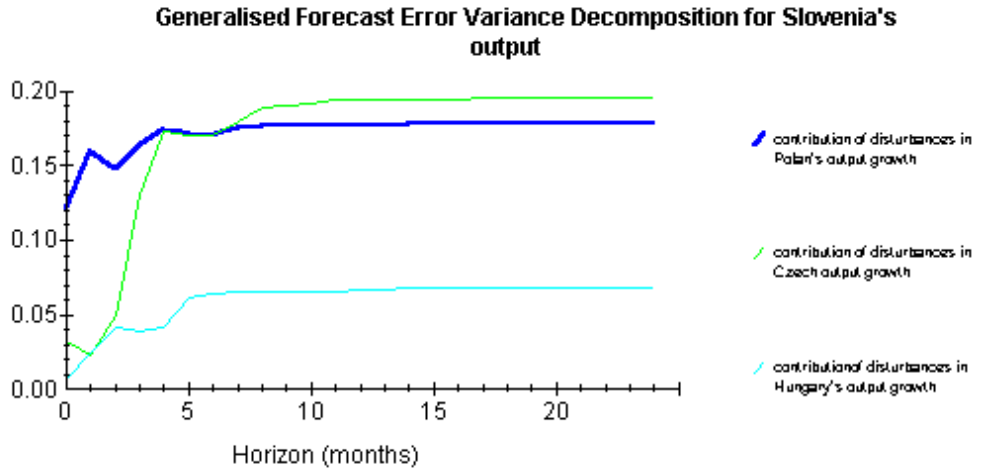

Fig.8. Contribution of disturbances in output growths of Poland, the Czech Rep. and Hungary to movements in Slovenia's output

The previous tests signalled that Slovenia's output growth could be threatened by asymmetric output shocks from EU and Austria (very low correlation coefficients). However, contribution of these shocks to movements in Slovenia's output would be less 5% for disturbances in EU output and approximately 11% for disturbances in Austria's production. It seems that the shocks transmitted from EU and Austria should not destabilise significantly Slovenia's output growth.

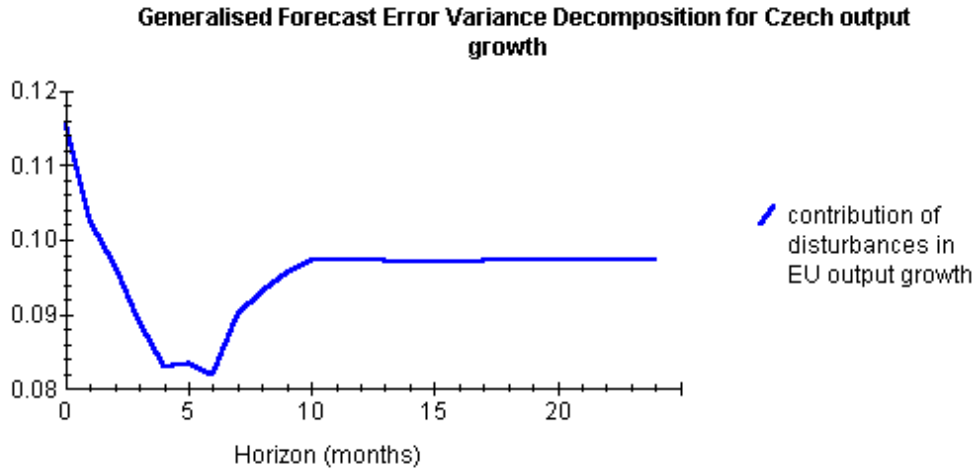

Fig.9. Contribution of disturbances in EU output growth to movements in the Czech Republic's output

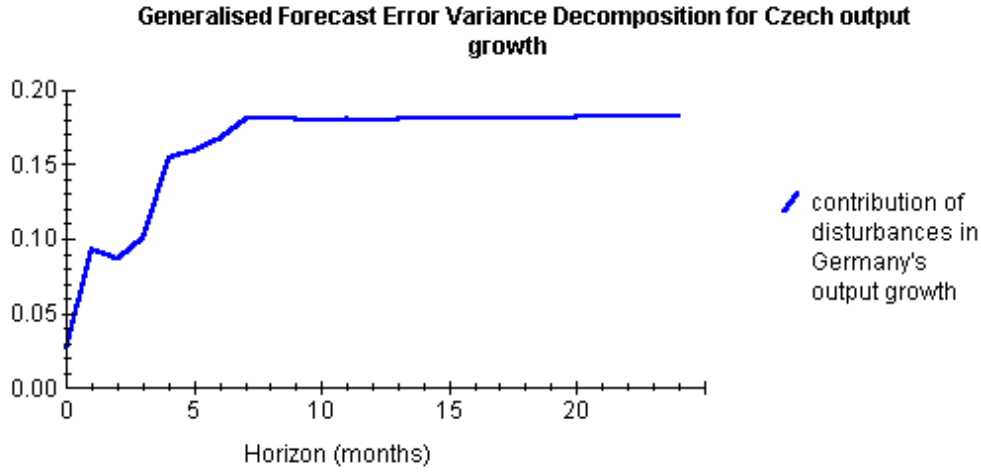

Fig.10. Contribution of disturbances in Germany's output growth to movements in the Czech Republic's output

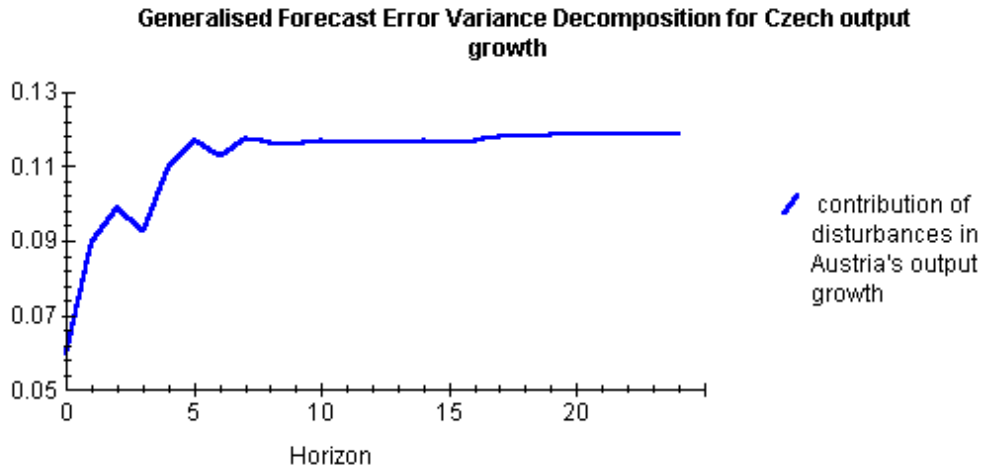

Fig.11. Contribution of disturbances in Austria's output growth to movements in the Czech Republic's output

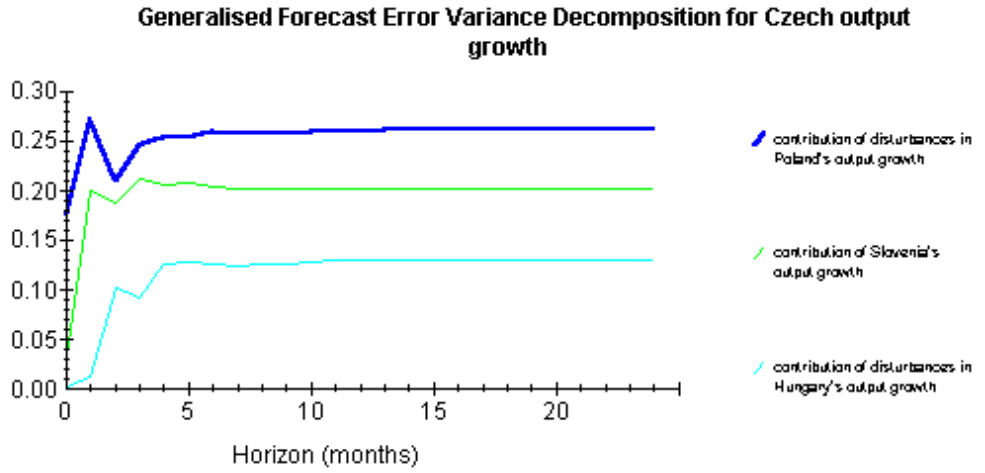

Fig.12. Contribution of disturbances in output growths of Poland, Slovenia and Hungary to movements in the Czech Republic's output

The results of the variance decomposition confirm that the Czech Republic can suffer from asymmetric shocks, specially transmitted from Slovenia. The contribution of disturbances in Slovenia's output growth to movements in Czech production would be equal to 20%. Two other asymmetric shocks transmitted from Hungary and Austria would contribute to the changes in Czech output only in approximately 13% and 12% respectively. However, taking into account that all three shocks would be asymmetric, in the worst situation if they arose simultaneously their contribution to movements in Czech production would be equal to 45%.

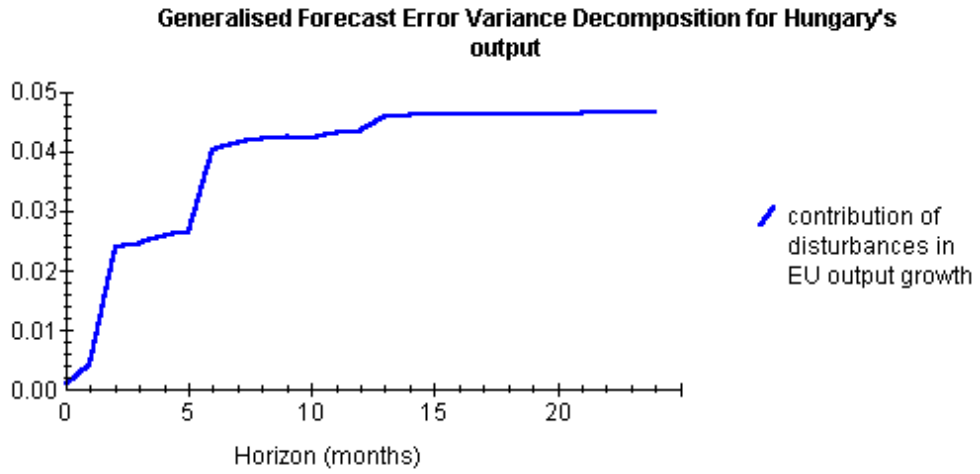

Fig.13. Contribution of disturbances in EU output growth to movements in Hungary's output

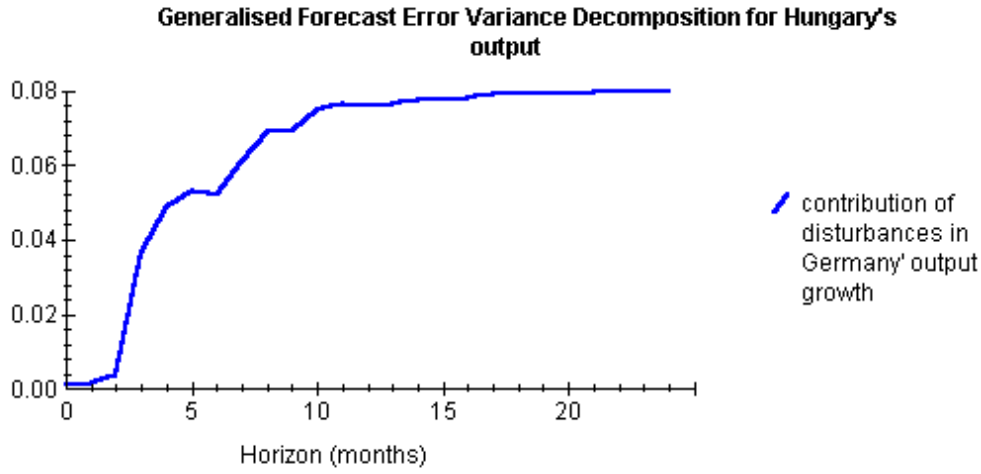

Fig.14. Contribution of disturbances in Germany's output growth to movements in Hungary's output

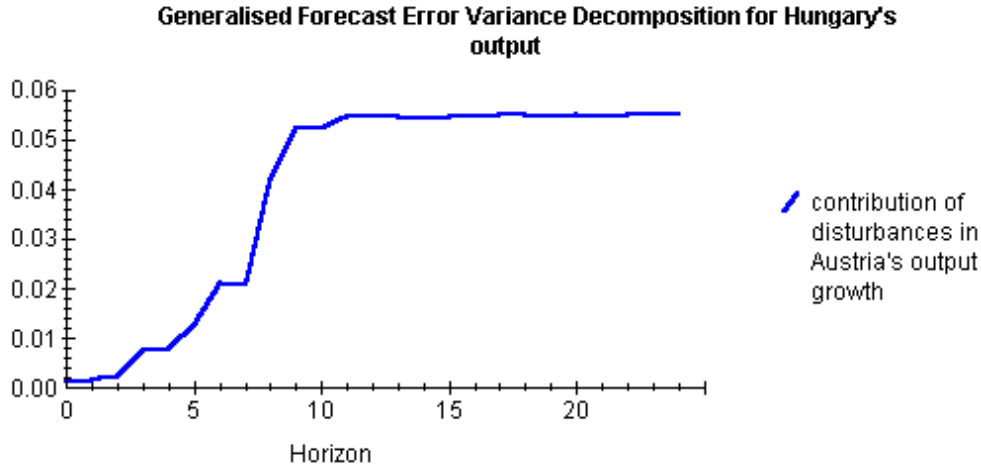

Fig.15. Contribution of disturbances in Austria's output growth to movements in Hungary's output

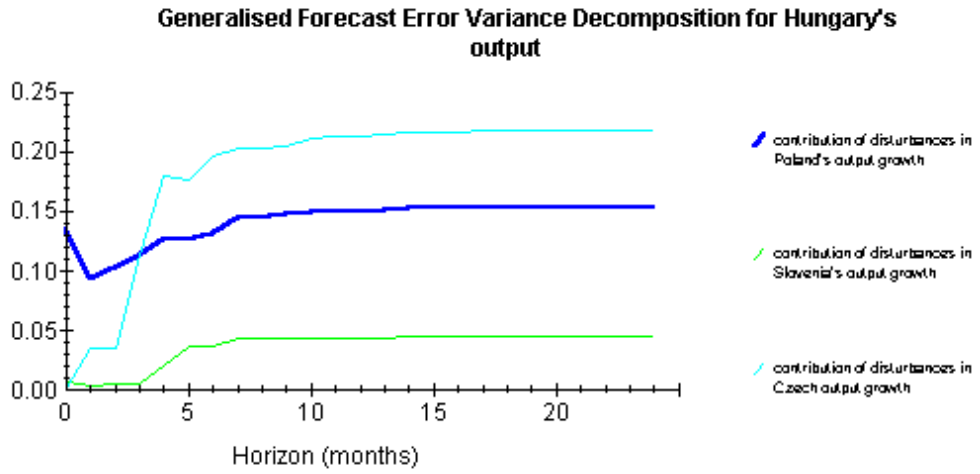

Fig.16. Contribution of disturbances in output growths of Poland, Slovenia and The Czech Republic to movements in Hungary's output

Hungary's output growth could be threatened only by output shock transmitted from the Czech Republic. This shock would contribute to the changes in Hungary's output in 21-22 %.

Finally the question whether the asymmetric output shock transmitted from Poland could destabilise EU output growth. The variance decomposition for EU output reveals that Poland' output shock would have the small impact on movements in EU production. The contribution of disturbances in Poland's production to the changes in EU output would be less than 7.5%. Movements in EU output would be due to disturbances in own production. The contribution of own disturbances would be equal to approximately 80%[v].

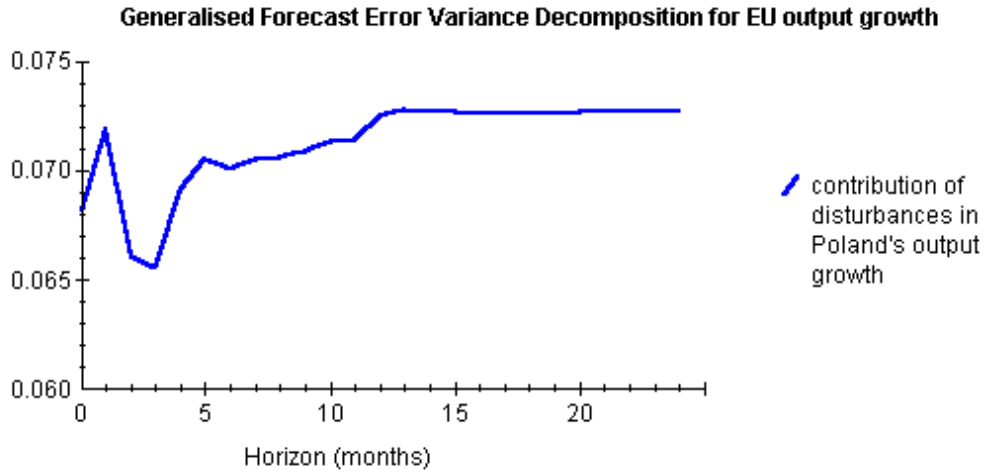

Fig.17. Contribution of disturbances in Poland's output growth to movements in EU Output

The last issue examined in the paper refers to the size of output shocks. The size is measured by the standard deviation of residuals from the output growth equation for particular countries in VAR models. The results are presented in Table 17.

Table 17. Size of shocks – standard deviations of output growth shocks

Sample: January 1993 – December 1999

	EU	Poland	Slovenia	Czech Rep.	Hungary
Standard deviation of residuals from the equation of the first VAR	0.0045	0.025	0.032	0.042	0.043

Sample: January 1993 – December 1999

	Germany	Poland	Slovenia	Czech Rep.	Hungary
Standard deviation of residuals from the equation of the second VAR	0.0103	0.0252	0.0333	0.0399	0.432

Sample: December 1994 – December 1999

	Austria	Poland	Slovenia	Czech Rep.	Hungary
Standard deviation of residuals from the equation of the third VAR	0.0181	0.0184	0.0301	0.0360	0.0326

Notes: All variables are measured in logarithms, so that for example 0.018 indicates a standard deviation of approximately 1.8 percent

First of all, there is a large difference in the size of shocks between EU and Germany on one hand and CECs on the other hand. It suggests that CECs with large shocks may be forced to an independent

economic policy response. The larger the size of the shocks, the more painful adjustment may be required.

Two more optimistic suggestions result from Table 17. The size of Poland's output shocks is the smallest within CECs and tends to lower over time. The size of shocks seems to lower also in regard to Hungary. Comparing the values of standard deviations obtained from particular VAR models is a base of these conclusions. The third VAR, including Austria's output and CEC outputs, was estimated in the shorter data period of 1995-1999, i.e. without years of 1993-1994 which can be counted among the first step of the transition process. The size of disturbances in Poland's production resulted from the third VAR, estimated in the period of 1995-1999, is smaller than resulted from the VARs for the period of 1993-1999. The size of Poland' output shock is the same like the size of Austria's shock.

One should expect that the European integration process within EU will accelerate reducing the size of shocks in CECs.

Conclusions

The findings suggest the following main conclusions:

- Output shocks have been transmitted from EU countries to CECs rather than opposite.
- They have been distributed asymmetrically, (except the shock transmitted from Germany to Poland), however, their contributions to movements in productions in CECs have been small. Therefore, it can be supposed that asymmetric shocks from EU countries have not been a main factor destabilising productions in CECs.
- Asymmetric shocks transmitted from one of CECs to other CECs seem to be more serious problem for the conduct of the common policy response than asymmetric shocks from EU countries. There are two reasons for this conclusion : 1) the size of shocks in CECs has been much larger than in EU and Germany and 2) the disturbances in outputs of particular CECs have contributed to the changes in production of a given CEC to larger extent than the disturbances in outputs of EU countries.

* * *

[i] For the discussion see: Artis and Zhang (1997), Backus and Kehoe (1992), Bayoumi and Eichengreen (1993), Bayoumi and Masson (1995), Bergman (1996), Blanchard and Quah (1989), Hodrick and Prescott (1997), Karras (1994)

[ii] The discussion on EU enlargement for Central and Eastern European Countries can be found: Boone and Maurel (1998), Boone and Maurel (1999), Burda (1998), Estrin and Urga (1997), Kocenda (1999), Wyplosz (2000).

[iii] Prices of 1995, construction excluded, seasonally adjusted data for the EU, Germany and Austria.

[iv] Shocks in the output equation are represented by innovations included in the residuals from this equation.

[v] The complete results of variance decomposition are available on the request.

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